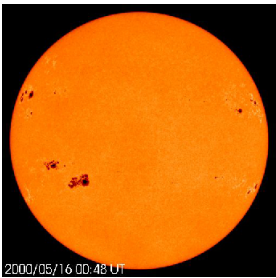


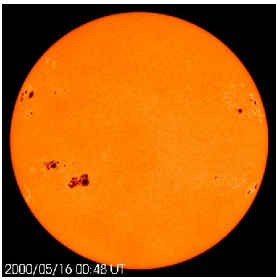
Interplanetary Solar Irradiance Monitor: IPSIR



IPSIR General Description 1 of 2

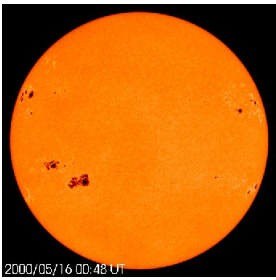
- IPSIR is a new generation, room temperature radiometer with four channels, which can be operated independently or in groups of two for internal comparisons. Each channel has its shutter and an independent cover for protection.
- IPSIR has electrically calibrated cavity receivers. Two cavities are operated together with one closed and the other with cyclic shutter phases of 50s open and 50s closed durations. Phase sensitive detection at the fundamental shutter frequency is used to analyze the signal. This operational mode has many advantages over the normal "active cavity" operation as in e.g. VIRGO, which relies on reaching a steady state before measurements can be taken (for a description of this novel way of operating radiometers see e.g. George M. Laurence *et al.* , 2000, "The Total Solar Irradiance Monitor: TIM", *Metrologia*, in press).
- In order to cope with the large change in solar irradiance from 1 to 0.2 AU three different apertures with 8, 4 and 2 mm diameter will be used at different phases of the mission. A set of four of these apertures is mounted on a aperture wheel in front of the cavities which allows the selection of one of the aperture sizes for all four cavities. These determine the area of the detectors and about 80mm back from these apertures are the view-limiting apertures of 12mm diameter in front of each conical-cylindrical cavity (14mm diameter and about 45mm long).

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IPSIR General Description 2 of 2

- **Irradiance:** At 1 AU with the 8mm aperture an area of 0.5cm^2 is illuminated with about 70mW with a radial fall-off to zero within 0.4mm, whereas at 0.2 AU with an aperture of 2mm a central area of 0.03cm^2 is illuminated with about 110mW with a radial fall-off to zero within 1.7mm. Thus, the non-equivalence between a homogenous electrical heating of the cavities and the highly inhomogeneous radiative heating and the different distances from the Sun will probably be the most important limiting factor of the uncertainty of the radiometers.
- The **operation** will be mostly digital and done by S/W in the instrument's computer. There are essentially only two analog circuitries. The amplifier of the thermistor bridge measuring the temperature difference between the two cavities. The bridge is powered by a sine wave at about 100Hz produced by S/W and its output is A-D converted and then demodulated by the computer. The demodulated signal is used to PID control the heater power in the shuttered cavity to compensate for the extra radiant power during the open periods. This heater power source is the second analog circuit. It is a highly stable voltage source which is pulse-width modulated by the output of the PID controller and feeds the necessary power to the shuttered cavity. This power signal is frequency analysed and the amplitudes and phases of the shutter fundamental frequency and a few harmonics of it (up to about the 8th) are transmitted to ground. Only the in-phase signal at the shutter fundamental is needed to calculate the irradiance. Some of the correction factors needed for



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IPSIR Specifications

- 4-Channel Radiometer with an uncertainty of <500ppm (tbc).
- The precision aperture diameters are 8, 4 and 2mm corresponding to areas of 0.5, 0.12 and 0.03cm²; the half-field view angle is 4.3° and the slope angles are 1.4°, 2.9° and 3.6° respectively
- Volume: 110x110x220mm with the 110x110mm face looking to the sun; in front there will be some (probably 2) radiation shields which will extend the length of the box by 40mm and the area of the front to 140x140mm.
- Mass: 4.0 kg including a contingency of 10%
- Power: total power consumption is estimated to 6.6W including a contingency of 10%. This estimate is still uncertain as the computer type has not yet been selected.
- The normal data rate (measuring with one radiometer) is 750 b/s. During a backup operation (about once a week) 280 b/s have to be added. During check-out tests a total of 3500 b/s will be needed; this mode is during commissioning and if problems have to be analysed.